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Simulation of Non-Newtonian Emulsion Flows in Microchannels

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Abstract

© 2015, Springer Science+Business Media New York. Simulation of emulsion flows in differently shaped microchannels to reproduce the choking of such flows as a result of the effect of dynamic blocking has been made. A model of a highly concentrated emulsion as a structure of tightly packed deformed droplets surrounded by elastic shells is considered. The motion of liquid was determined by the method of the lattice Boltzmann equations together with the immersed boundary method. The influence of the non-Newtonian properties and of elastic turbulence of the indicated emulsion, as well as of the elasticity of the shells of its droplets and of the interaction of these shells on the emulsion motion in a microchannel, has been investigated. It is shown that the flow of this emulsion can be slowed down substantially only due to the mutual attraction of the shells of its droplets.

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Keywords

computational hydrodynamics, effect of dynamic blocking, emulsion, method of immersed boundary, method of the lattice Boltzmann equations